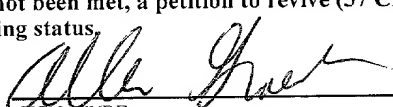


|   |  |   |  |   |  |
|---|--|---|--|---|--|
| FORM P-1390<br>(REV. 11-2000)   |  | U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE |  | ATTORNEY'S DOCKET NUMBER<br>32414.24.1                              |  |
| TRANSMITTAL LETTER TO THE UNITED STATES<br>DESIGNATED/ELECTED OFFICE (DO/EO/US)<br>CONCERNING A FILING UNDER 35 U.S.C. 371  |  |   |  | U.S. APPLICATION NO. (If known, see 37 CFR 1.5)<br><b>09/806962</b> |  |
| INTERNATIONAL APPLICATION NO.<br>PCT/GB99/01936   |  | INTERNATIONAL FILING DATE<br>18 June 1999               |  | PRIORITY DATE CLAIMED<br>05 October 1998                            |  |
| TITLE OF INVENTION<br>LITHOPHANE-LIKE ARTICLE AND METHOD OF MANUFACTURE   |  |   |  |   |  |
| APPLICANT(S) FOR DO/EO/US<br>DUFORT, John Francis   |  |   |  |   |  |
| Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:   |  |   |  |   |  |
| <p>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</p> <p>4. <input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</p> <p>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))</p> <p style="margin-left: 20px;">a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</p> <p style="margin-left: 20px;">b. <input checked="" type="checkbox"/> has been communicated by the International Bureau.</p> <p style="margin-left: 20px;">c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</p> <p>6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).</p> <p style="margin-left: 20px;">a. <input type="checkbox"/> is attached hereto.</p> <p style="margin-left: 20px;">b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</p> <p>7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p style="margin-left: 20px;">a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</p> <p style="margin-left: 20px;">b. <input type="checkbox"/> have been communicated by the International Bureau.</p> <p style="margin-left: 20px;">c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p style="margin-left: 20px;">d. <input checked="" type="checkbox"/> have not been made and will not be made.</p> <p>8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p> |  |   |  |   |  |
| Items 11 to 20 below concern document(s) or information included:   |  |   |  |   |  |
| 11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98; PTO Form 1449; Cited References   |  |   |  |   |  |
| 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.  |  |   |  |   |  |
| 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment.  |  |   |  |   |  |
| 14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.  |  |   |  |   |  |
| 15. <input type="checkbox"/> A substitute specification.  |  |   |  |   |  |
| 16. <input type="checkbox"/> A change of power of attorney and/or address letter.   |  |   |  |   |  |
| 17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.  |  |   |  |   |  |
| 18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).  |  |   |  |   |  |
| 19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).  |  |   |  |   |  |
| 20. <input checked="" type="checkbox"/> Other items or information: Return Receipt Postcard   |  |   |  |   |  |
| EXPRESS MAIL LABEL NO. EL486396600US  |  |   |  |   |  |

|  |              |   |                              |
|--|--------------|---|------------------------------|
| U.S. APPLICATION NO. <b>09/806962</b><br>INTERNATIONAL APPLICATION NO. <b>PCT/GB99/01936</b>   |              | ATTORNEY'S DOCKET NUMBER<br><b>32414.24.1</b>   |                              |
| 21. <input checked="" type="checkbox"/> The following fees are submitted:<br><b>BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):</b><br>Neither international preliminary examination fee (37 CFR 1.482)<br>nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO<br>and International Search Report not prepared by the EPO or JPO. .... <b>\$1000.00</b><br><br>International preliminary examination fee (37 CFR 1.482) not paid to<br>USPTO but International Search Report prepared by the EPO or JPO ..... <b>\$860.00</b><br><br>International preliminary examination fee (37 CFR 1.482) not paid to USPTO<br>but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... <b>\$710.00</b><br><br>International preliminary examination fee (37 CFR 1.482) paid to USPTO<br>but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... <b>\$690.00</b><br><br>International preliminary examination fee (37 CFR 1.482) paid to USPTO<br>and all claims satisfied provisions of PCT Article 33(1)-(4) ..... <b>\$100.00</b><br><br><b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b> |              | <b>CALCULATIONS PTO USE ONLY</b>  |                              |
| Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30<br>months from the earliest claimed priority date (37 CFR 1.492(e)).   |              | <b>\$ 860.00</b><br><br><b>\$ 130.00</b>  |                              |
| CLAIMS   | NUMBER FILED | NUMBER EXTRA  | RATE                         |
| Total claims   | 35 - 20 =    | 15  | x \$18.00                    |
| Independent claims   | 8 - 3 =      | 5   | x \$80.00                    |
| MULTIPLE DEPENDENT CLAIM(S) (if applicable)  |              |   | + \$270.00                   |
| <b>TOTAL OF ABOVE CALCULATIONS =</b>   |              |   | <b>\$ 1,660.00</b>           |
| <input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above<br>are reduced by 1/2.   |              |   | +<br><b>\$ 830.00</b>        |
| <b>SUBTOTAL =</b>  |              |   | <b>\$ 830.00</b>             |
| Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30<br>months from the earliest claimed priority date (37 CFR 1.492(f)).   |              |   | <b>\$ 0</b>                  |
| <b>TOTAL NATIONAL FEE =</b>  |              |   | <b>\$ 830.00</b>             |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be<br>accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00</b> per property +   |              |   | <b>\$ 0</b>                  |
| <b>TOTAL FEES ENCLOSED =</b>   |              |   | <b>\$ 830.00</b>             |
|  |              |   | Amount to be<br>refunded: \$ |
|  |              |   | charged: \$                  |
| a. <input checked="" type="checkbox"/> A check in the amount of \$ <u>830.00</u> to cover the above fees is enclosed.<br><br>b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.<br>A duplicate copy of this sheet is enclosed.<br><br>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any<br>overpayment to Deposit Account No. <u>06-1910</u> . A duplicate copy of this sheet is enclosed.<br><br>d. <input type="checkbox"/> Fees are to be charged to a credit card. <b>WARNING:</b> Information on this form may become public. <b>Credit card</b><br><b>information should not be included on this form.</b> Provide credit card information and authorization on PTO-2038.   |              |   |                              |
| <b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.</b>  |              |   |                              |
| SEND ALL CORRESPONDENCE TO<br><b>Allen Groenke</b><br><b>Fredrikson &amp; Byron, P.A.</b><br><b>1100 International Centre</b><br><b>900 Second Avenue South</b><br><b>Minneapolis, MN 55402</b><br><b>(612) 752-2640</b>   |              | <br>SIGNATURE<br><br><u>Allen Groenke</u><br>NAME<br><br><u>42,608</u><br>REGISTRATION NUMBER |                              |

09/806962

JC08 Rec'd PCT/PTO 05 APR 2001

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: )  
 )  
 DUFORT, John Francis )  
 )  
 Int'l App. No.: PCT/GB99/01936 )  
 )  
 Int'l Filing Date: 18 June 1999 )  
 )  
 App. No.: (not yet assigned) )  
 )  
 Filing Date: (filed concurrently herewith) )  
 )  
 For: LITHOPHANE-LIKE ARTICLE AND )  
METHOD OF MANUFACTURE )


Atty. Docket No.: 32414.24.1

Express Mail Label No.: EL486396600USDate of Deposit: 05 April 2001

I hereby certify that this paper is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Allen GROENKE

Name of Person Making Deposit



Signature

Box PCT  
 Assistant Commissioner for Patents  
 Washington, D.C. 20231

**PRELIMINARY AMENDMENT**

The present Preliminary Amendment is being filed concurrently with the National Stage application identified above. Prior to calculating the filing fee due in the above-identified application, please enter the Preliminary Amendment set forth below. A VERSION WITH MARKINGS TO SHOW CHANGES MADE is attached as an appendix hereto in which deletions are designated by brackets and insertions of new language are underlined.

**IN THE CLAIMS**

Claims 1-2, 5-6, 8 and 22-26 are unchanged.

Claims 3-4, 7, 9-21 and 27-31 are amended as follows:

3. (Amended) A method according to Claim 1, in which the relative intensities of the different points of the original image is determined by scanning the image into a computer.
4. (Amended) A method according to Claim 1, in which the image is analysed by dividing the image into separate picture elements, and determining the intensity of each picture element.

7. (Amended) A method according to Claim 1, in which the step of forming the article includes the step of forming a mould having a relief corresponding to the relative intensity of the points of the original image and moulding the article from a translucent material in the mould to form an article having different thicknesses corresponding to the different intensities of the original image.

9. (Amended) A method according to Claim 7, in which the step of forming the mould is an engraving step.

10. (Amended) A method according to Claim 1, in which the step of forming the article comprises the step of engraving translucent material.

11. (Amended) A method according to Claim 10, in which the engraving step is achieved using a numerically controlled engraving machine.

12. (Amended) A method according to Claim 10, in which the engraving step is achieved using laser engraving.

13. (Amended) A method according to Claim 1, in which the article is formed from a plastics material.

14. (Amended) A method according to Claim 1, in which the article is formed from a confectionery material.

15. (Amended) A method according to Claim 1, in which the article is formed from a soap.

16. (Amended) A method according to Claim 1, in which the article is formed from a wax.

17. (Amended) A method according to Claim 1, in which the material includes luminescent particles.
18. (Amended) A method according to Claim 1, including the further step of providing a luminescent layer on or in the article.
19. (Amended) A method according to Claim 1, in which the article is formed of a coloured material.
20. (Amended) A method according to Claim 1, including the further step of providing a coloured layer on or in the article.
21. (Amended) A method according to Claim 1, in which the article is made from a heat sensitive material whose light transmissive properties vary dependent on the temperature of the material.
27. (Amended) An article according to Claim 26, in which the material includes luminescent particles.
28. (Amended) An article according to Claim 26, in which a luminescent layer is provided on or in the article.
29. (Amended) An article according to Claim 26, in which the article is formed of a coloured material.
30. (Amended) An article according to Claim 26, in which a coloured layer is provided on or in the article.

31. (Amended) An article according to Claim 26, in which the article is made from a heat sensitive material whose light transmissive properties vary dependent on the temperature of the material.

Please add new Claims 32-35 as indicated below:

32. (New) A method of forming a plastics article through which an image is observable when the article is illuminated with light from behind due to variations in the thickness of the material of the article corresponding to variations in intensity of the image to be observed, the method comprising the steps of:

determining the relative intensity at different points of an image;

converting the determined relative intensity into data for controlling a mould forming machine;

automatically forming a mould in which the relief on the mould surface corresponds to the determined relative intensity; and

moulding the article in the mould, the article being moulded from a translucent plastics material including a pigmentation.

33. (New) A method of forming an article through which an image is observable when the article is illuminated with light from behind due to variations in the thickness of the material of the article corresponding to variations in intensity of the image to be observed, the method comprising the steps of:

determining the relative intensity at different points of an image;

converting the determined relative intensity into data for controlling a tool forming machine;

automatically forming a tool having a tool surface corresponding to the determined relative intensity; and

pressing the tool onto a material surface of a material from which the article is to be formed.

34. (New) The method of Claim 33, wherein the tool is selected from the group consisting of a die, a punch, and a stamp.

35. (New) The method of Claim 33, wherein the material comprises chewing gum.

### REMARKS

The present Preliminary Amendment is being filed concurrently with the National Stage application identified above. Claims 1-35 are currently pending in this application. By this Preliminary Amendment, claims 1-2, 5-6, 8 and 22-26 remain unchanged, claims 3-4, 7, 9-21 and 27-31 are amended, and new claims 32-35 are added.

Applicant respectfully requests that the present amendment be entered before the calculation of filing fees. The Commissioner is hereby authorized to charge any additional filing fees required to Deposit Account No. 06-1910.

Respectfully submitted,



Allen GROENKE  
Registration No. 42,608  
FREDRIKSON & BYRON, P.A.  
110 International Centre  
900 Second Avenue South  
Minneapolis, MN 55402-3397  
(612) 752-2640

Dated: 05 April 2001

## APPENDIX

### VERSION WITH MARKINGS TO SHOW CHANGES MADE

Amendments to Claims 3-4, 7, 9-21 and 27-31.

3. (Amended) A method according to Claim 1 [or Claim 2], in which the relative intensities of the different points of the original image is determined by scanning the image into a computer.

4. (Amended) A method according to [any preceding] Claim 1, in which the image is analysed by dividing the image into separate picture elements, and determining the intensity of each picture element.

7. (Amended) A method according to [any one of the preceding claims] Claim 1, in which the step of forming the article includes the step of forming a mould having a relief corresponding to the relative intensity of the points of the original image and moulding the article from a translucent material in the mould to form an article having different thicknesses corresponding to the different intensities of the original image.

9. (Amended) A method according to Claim 7 [or 8], in which the step of forming the mould is an engraving step.

10. (Amended) A method according to [any one of Claims] Claim 1 [to 6], in which the step of forming the article comprises the step of engraving translucent material.

11. (Amended) A method according to Claim [6, 9 or] 10, in which the engraving step is achieved using a numerically controlled engraving machine.



12. (Amended) A method according to Claim [6, 9 or] 10, in which the engraving step is achieved using laser engraving.

13. (Amended) A method according to [any one of the preceding claims] Claim 1, in which the article is formed from a plastics material.

14. (Amended) A method according to [any one of claims] Claim 1 [to 12], in which the article is formed from a confectionery material.

15. (Amended) A method according to [any one of claims] Claim 1 [to 12], in which the article is formed from a soap.

16. (Amended) A method according to [any one of claims] Claim 1 [to 12], in which the article is formed from a wax.

17. (Amended) A method according to [any one of the preceding claims] Claim 1, in which the material includes luminescent particles.

18. (Amended) A method according to [any one of the preceding claims] Claim 1, including the further step of providing a luminescent layer on or in the article.

19. (Amended) A method according to [any one of the preceding claims] Claim 1, in which the article is formed of a coloured material.

20. (Amended) A method according to [any one of the preceding claims] Claim 1, including the further step of providing a coloured layer on or in the article.

21. (Amended) A method according to [any one of the preceding claims] Claim 1, in which the article is made from a heat sensitive material whose light transmissive properties vary dependent on the temperature of the material.
27. (Amended) An article according to [any one Claims] Claim [22 to] 26, in which the material includes luminescent particles.
28. (Amended) An article according to [any one of Claims] Claim 26 [22 to 27], in which a luminescent layer is provided on or in the article.
29. (Amended) An article according to [any one of Claims] Claim 26 [22 to 28], in which the article is formed of a coloured material.
30. (Amended) An article according to [any one of Claims] Claim 26 [22 to 29], in which a coloured layer is provided on or in the article.
31. (Amended) An article according to [any one of Claims] Claim 26 [22 to 30], in which the article is made from a heat sensitive material whose light transmissive properties vary dependent on the temperature of the material.

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JC08 Rec'd PCT/PTO 05 APR 2001

1

LITHOPHANE-LIKE ARTICLE AND METHOD OF MANUFACTURE

In the late nineteenth and early twentieth centuries, lithophanes were formed from porcelain.

5 These objects were pieces of porcelain which were formed with sections of various thickness. The porcelain was fired at a very high temperature, resulting in the porcelain becoming translucent. By shining light through the porcelain from behind, as a result of the  
10 different thicknesses of the porcelain and therefore the different transmissivity of light through the porcelain, an image is seen. In particular, the thicker areas of the porcelain are less transmissive to light than thinner areas, and so appear darker.

15

In the early part of the twentieth century, lithophanes were formed by hand engraving wax with the relief corresponding to the areas of different  
brightness of the desired image. These wax models were  
20 used to form a mould which could be used to mould ceramic to form the lithophane. Such lithophanes were used as window hangings, fire screens, teapot warmers and lamps.

25 From around the 1930's, there was no longer any great interest in lithophanes, and they are rarely seen today.

The present invention relates to an article  
30 having different thicknesses corresponding to the different intensities of an image, and to a method of forming such an article, the resulting article having a similar appearance to a porcelain lithophane.

35 According to a first aspect of the present invention, a method of forming an article comprises the steps of:

determining the relative intensity at  
different points of an image; and

forming the article with different thicknesses  
corresponding to the different intensities of the  
5 original image from a translucent material.

In accordance with the present invention, it  
is possible to replicate a desired image, for example a  
photograph or computer generated image, into an article  
10 such that the image can be observed with suitable  
lighting. This is possible by virtue of the step of  
determining the relative intensity of different points  
of the original image and the automatic use of this to  
form the final article with a variable thickness  
15 corresponding to the relative intensities. This differs  
from lithophanes which were generated as works of art in  
their own right.

It is preferred that the determination of the  
20 relative intensity of the different points of the image  
is achieved by scanning the image, for example into a  
computer. In this case, the original image may be  
divided into a number of picture elements, and an  
intensity value for each element determined.  
25 The intensity values are then preferably stored in  
memory for subsequent use in forming the article. In  
this way, the original image can accurately be recreated  
in the article. By storing the intensity values in a  
memory, it is possible to process the values, for  
30 example to normalise these, or vary these for different  
materials. It is also possible to enlarge or reduce the  
image, or to edit the image, for example by deleting  
parts of the image or combining images.

35 It is preferred that the step of forming the  
article comprises the step of forming a mould, and  
moulding the article in the mould. By moulding the  
article, for example by injection moulding techniques,

mass reproduction is possible. This allows the production of large volumes of product at a low cost, and this in turn increases the number of uses for the article.

5

Preferably the step of forming the mould is carried out by a numerically controlled engraving machine, such as a high speed three axis numerically controlled engraving machine. This can be loaded with  
10 the relative intensity values of the desired mould, and can cut any desired number of moulds. If a non-flat article is to be produced, a four or five axis numerically controlled engraving machine may be needed.

Alternatively, the mould may be formed by a laser  
15 cutting machine, by spark erosion in which a spark erosion electrode having a relief corresponding to the finished article is formed and is used to form the mould, or by stereo lithography or other techniques. The use of these methods for forming the mould are  
20 especially suited to a method in which the data representing the relative intensity of the picture elements is held in a digital memory. In this case, the data can be used directly for defining, for example, the cutter toolpaths or the stereo lithography. This allows  
25 for the rapid, reproducible and accurate formation of moulds for use in producing the finished articles. The accuracy allows greater detail to be seen in the finished article.

30 The mould is preferably formed from metal. This allows materials to be moulded which are heated to a high temperature to melt the material before being cooled to set. Such a mould may also have a long life to allow for repeated mouldings. Alternatively, the  
35 mould may be a flexible mould, for example formed of rubber or polyethane. This is especially suitable where the article is made from a fragile material, as it allows the article to be removed from the mould easily,

for example by peeling off the mould, without damaging the article.

It is preferred that a number of moulds are  
5 formed from a single mould block to allow a large number of articles to be moulded simultaneously.

In an alternative example of the present invention, the article is formed by machining or  
10 otherwise forming the article directly from a translucent material based on the determined relative intensity so that the article has a relief such that the thickness corresponds to the different intensities of the desired image.

15 This method of forming articles does not allow for the same economy of scale and mass reproduction associated with moulding, but is able to produce limited quantities of articles having a specific design. For  
20 example, a person's image can be obtained from a digital camera or from a scanned photograph, and machined into an article. This will be difficult to replicate, and so can be used as a security or identification device.

25 The article may be formed by a number of methods, including those described above for the forming of a mould, including engraving by a numerically controlled engraving machine, by laser cutting, spark erosion or stereo lithography.

30 In a further example, the determined relative intensity data is used to form a die, punch or stamp. The die, punch or stamp, as with the mould, may be formed by machining, such as by a numerically controlled  
35 engraving machine, by laser cutting, spark erosion or by stereo lithography. To form the article, the die, punch or stamp is pressed onto the surface of the material from which the article is to be formed, and leaves an

imprint in the material, giving the desired thickness variation for the article. Depending on the material used to form the article, the punch, die or stamp may be heated prior to being pressed into the material. These techniques are particularly suitable for the formation of articles in which a moulding step is difficult in the context of the normal production process.

A material which is especially suitable for stamping is chewing gum which is usually formed in strips that are cut to size. The stamping of a relief in a strip of chewing gum can be linked with the cutting of the strip to the required size. Especially where the article is formed in a strip, the punch, die or stamp may be provided on a roller.

Preferred materials from which the article may be formed include plastics, confectionery products including chewing gum, candy and chocolate, wax, soap and liquids.

A particularly preferred material is plastics. Such an article is advantageous over a porcelain lithophane in that it is significantly cheaper and easier to manufacture, does not require firing at a high temperature and is less susceptible to damage. Further, by selection of a suitable material, it is possible to see the image clearly when the article is back lit by a particular type or intensity light source.

In the case of liquid, the liquid may remain in the mould to maintain the different thicknesses.

According to an alternative example of the present application, there is provided a plastics article having different thicknesses at different positions corresponding to the relative intensity of an image, in which the plastics article transmits or emits

light with an intensity corresponding to the thickness of the material.

The material from which the plastics articles  
5 are formed should be transparent or translucent, for example may be polystyrene, polypropylene, styrolux, ABS or acrylic or an epoxy, polystyrene or polyurethane resin. The plastics material is preferably filled with a filler material such as china clay, chalk or other  
10 filter to give the desired effect.

The use of plastics is preferred since this is inexpensive, can be formed to the desired shape easily, for example by heating to make the material mouldable  
15 and cooling to set, and is resilient, making it less likely to break than porcelain. Plastics materials may also be used for a wide range of products for use in a large number and variety of environments.

20 Alternative materials from which the article may be formed include confectionery products, wax, soap and liquid.

Where confectionery products, for example  
25 chocolate, candy or chewing gum, is used, the finished articles can be eaten. As many confectionery products are shaped to give desirable appearance, little if any additional cost is required to form the product into an article in accordance with the present invention, but  
30 the resulting article has a very attractive appearance, increasing its value.

Where the article is formed from liquid, it is preferred that the article comprises a container formed  
35 from substantially transparent material in which the cross-sectional area between opposite walls corresponds to the relative intensity of the image, and liquid provided in the container. The container may be in the



form of a bottle. The liquid may be a beverage or detergent or cosmetic, such as shampoo. To give the desired effect, the liquid should preferably be of uniform density and transmissivity, and should be  
5 translucent.

The material from which the article is formed may include luminescent particles or may be coated on the back by a luminescent layer. In this case, the  
10 luminescent particles emit light, and it may therefore be possible to view the image without light from a separate source being shone through the article. Where luminescent particles are included, the lighter parts of the image may correspond to the thicker parts of the  
15 article and the darker parts to the thinner parts as, in this case, in the thicker regions there will be a greater amount of luminous particles and therefore there will be a brighter section.

20 The article may be coloured. In this case, the article may be coloured with a single colour to give an overall tint, or there may be different colours at different parts of the article to give parts of different colour.

25

Where the colour is a single colour, this may be achieved by including pigment in the material used for the moulding. Alternatively, a coloured layer may be formed on a surface of the article. One surface of  
30 the article, for example the rear surface, will usually be planar, and therefore a coloured layer can be formed on this surface easily, for example by transfer or sublimation printing or by an ink jet or silk screen printing technique. This will act as a filter to the  
35 light passing through the article. Alternatively, a separate layer may be provided with the appropriate colours which is provided behind or in front of the

article. This allows the colour to be formed separately.

The article may be formed from heat sensitive material. In this case, the image may only be seen when the article is heated. For example, if the article is formed into a lamp shade, it may be heated by the lamp to become translucent.

10 The article according to the present invention can be used for a number of purposes, including character promotions, key rings, inserts to be provided in cereal packets, light shades, plates, cups, toys, pictures etc. Where the article is made from an edible  
15 material, such as chocolate or candy, the article may be sold as a novelty food item. A candle can be formed where the article is made from wax.

By use of suitable processing techniques, the  
20 article may be a non-flat or three-dimensional article. It is also possible to produce a stereoscopic image by having two side by side articles having substantially the same image but from a slightly different perspective, each of the images being viewed by a  
25 different one of the viewer's eyes.

In an alternative example, both surfaces of the article include relief. In this case, the overall thickness of the material at any point corresponds to  
30 the relative intensity of the image at that point, however the article is recessed on both sides. This gives an article which can be viewed from either side. Where the article includes one flat surface and the relief is provided exclusively in the other surface, the  
35 image can only be viewed properly from the relieved side of the article. Where both surfaces of the article include relief, it is preferred that the article is recessed on both sides to a generally similar amount.

This eases the manufacture of the article. For example, where the article is formed in a mould, the two parts of the mould may be engraved as a mirror image of each other.

5

The article may be formed as a single piece, or may be formed in two parts which are fixed back-to-back. Where the article is formed in two parts and these are fixed back-to-back, such fixing may be by means of an adhesive, or may be by a mechanical interconnection or clamp. Where the article is formed in two parts, it is possible to provide a coloured or luminescent layer between the two parts before these are assembled together to give the desired colour filter or radiation of light as required.

Examples of the present invention will be described in accordance with the accompanying drawings, in which:

20 Figure 1 shows a schematic view of the system for forming an article;

Figure 2 shows a cross-section through a mould for forming an article;

Figure 3 shows a cross-section through an alternative example of an article; and,

Figure 4 shows a bottle of liquid including the features of the present invention.

As shown in Figure 1, an image 1, for example a photograph or painting, is scanned by a scanner 2 to convert the image 1 into electronic data which corresponds to the image 1. The data corresponding to the scanned image is input to a processor 3. Alternatively, the image may be generated initially in electronic form, for example using a graphics package, or may be loaded from a store of pre-converted or generated images, for example from a CD-ROM, or downloaded, for example from the Internet.

The processor 3 analyses the data corresponding to the image to determine the relative intensity, i.e. the relative darkness or lightness, at 5 different points or pixels of the image. This analysis may be achieved using commercially available computer aided design or computer aided milling software. This intensity information is provided to a numerically controlled milling machine from the software which is 10 able to use the intensity data to machine one half 11 of a mould in which the depth of the mould at different positions corresponds to the relative intensities of the original image. In a preferred example, the mould has a greater depth where the corresponding position of the 15 original image has a low intensity (i.e. where the image is dark), and has a shallower depth where the corresponding position of the original image has a high density (i.e. where the image is light).

20 The machined mould half 11 and an associated mould half 10 having a generally flat surface, are placed together to form a mould cavity, and plastics material is injected into the mould cavity. To give the plastics material the required translucent properties, a 25 filler material such as china clay, chalk or other filter material is added to the plastics before this is injected into the mould cavity.

When the plastics material has set, it is 30 removed from the mould. The resulting article will be translucent, and will have a greater thickness in those areas corresponding to darker areas of the original image than the areas corresponding to the lighter areas of the original image. When light is shone through the 35 article from behind, the light is transmitted through the thinner parts of the article more easily than through the thicker parts of the article, and therefore the thinner areas appear lighter than the thicker areas.

This corresponds generally to the light and dark areas of the original image, and therefore an image corresponding to the original image can be seen.

5           The article may be coloured on the back by any suitable printing technique, for example by ink jet printing. In this case, the colour is easy to apply as it is applied to the flat rear surface of the article. The coloured layer on the back of the article acts as a  
10 colour filter which only lets light of selected wavelengths pass through the layer and hence through the translucent article, and therefore the light viewed through the article is of certain colours. Where the rear of the article is coloured substantially entirely  
15 with a single colour, the whole image viewed through the article will have a colour tint, however it is preferred that the rear of the article is selectively coloured with areas of different colour. This allows the light transmitted through different parts of the article to be  
20 of different colours, which may correspond to the colours of the original image.

          Alternatively, a coloured pigment may be added to the plastics material before this is injected into  
25 the mould. In this case, the pigment within the plastics material will act as a filter to allow only light of certain wavelengths to be transmitted to form the view image.

30           It is also possible to add a luminescent pigment to the plastics material used to injection mould the article. In this case, it is not necessary for a separate back light to be used to view the article, since the article will itself emit light. In this case,  
35 the mould is made in reverse to that described above, with the areas corresponding to the lighter sections of the image being formed more deeply than the areas corresponding to the darker areas. In this case, the

plastics article moulded by the mould will be thicker in those areas corresponding to lighter areas of the original image, and therefore will have a greater amount of luminescent pigment, and therefore will emit more  
5 light than the thinner areas corresponding to the darker regions of the original image which will have less luminescent material and therefore will emit less light.

An alternative example of an article according  
10 to the present invention is shown in cross-section in Figure 3. In this example, rather than the article being formed with a flat rear surface and a front surface having a relief corresponding to the relative intensity of the different parts of the image, the  
15 article is formed with a corresponding relief on both faces. This can be achieved either by forming the two mould halves with a corresponding, mirror image, relief, the relief in each part corresponding to half the required relief for the desired overall thickness of the  
20 finished product, or by engraving with a CNC machine. Alternatively, as shown in the example of Figure 3, the article can be formed in two parts, each part having one flat face and one face with relief, each part made in accordance with any of the methods described herein.

25

In this case, the two parts of the article are fixed together in back-to-back relation. Due to the variation in thickness of the complete article, there will be a similar transmission of light as with a single  
30 article having a flat rear face. However, it is possible to view the image through the article from either side, whereas when one face is flat, it is difficult to view the image from this flat face.

35

As shown in Figure 3, a coloured layer is printed on the flat face of one part of the article. In the complete article, this layer is sandwiched between the two parts of the article and therefore is not

susceptible to damage, for example by wear or scratching. The coloured layer may alternatively or additionally be a luminous layer, in which case it may not be necessary to hold the article to a light source  
5 when the image is viewed. The two parts of the article are then joined by a suitable adhesive.

As with the first example, it is possible to provide a coloured or luminescent layer on one face of  
10 the article, or to make the article of a plastics material including coloured or luminescent particles.

The injection moulded articles according to the present invention, which, due to the method of  
15 manufacture can be formed inexpensively and in large numbers, can be used in many different applications, for example, but not limited to, character promotions, key rings, inserts to be provided in cereal packets, light shades, plates, cups, and pictures.

20 It may also be possible to form a plastics article having variable thickness or contour corresponding to the relative intensity of an original image by engraving the article directly, for example  
25 using a CNC machine, in the same way as described above for forming the mould. In this case, it would be simple to make one-off items, for example it would be possible to convert an image of a person's face into data relating to the relative intensity of the image, and  
30 directly engrave a plastics article with different thickness regions corresponding to the different intensities of the image of the person's face. This could be used as a security device, for example as an identification card, which would be very difficult to  
35 forge.

In an alternative example, a bottle is formed of transparent material in which the width of the bottle

varies to correspond to the relative intensity of an image. When the bottle is filled with liquid, the amount of liquid will correspond to the relative intensity of the original image. Where the liquid is  
5 translucent, this variation in the amount of liquid will give darker and lighter regions. A cross-section of a bottle is shown in Figure 4.

Figure 4



CLAIMS

1. A method of forming an article, the method comprising the steps of:
  - 5 determining the relative intensity at different points of an image;  
forming an article from a translucent material so that the article has a relief such that the thickness corresponds to the different intensities of the image.
- 10 2. A method according to Claim 1, in which the article has thicker portions corresponding to the darker regions of the original image, and thinner portions corresponding to the lighter regions of the original  
15 image.
3. A method according to Claim 1 or Claim 2, in which the relative intensities of the different points of the original image is determined by scanning the image into  
20 a computer.
4. A method according to any preceding claim, in which the image is analysed by dividing this into separate picture elements, and determining the intensity of each  
25 picture element.
5. A method according to Claim 4, in which a value corresponding to the intensity of each picture element is stored in memory.
- 30 6. A method according to Claim 5, in which the stored values are used to control a computer driven engraving machine to form the article.
- 35 7. A method according to any one of the preceding claims, in which the step of forming the article includes the step of forming a mould having a relief corresponding to the relative intensity of the points of

the original image and moulding the article from a translucent material in the mould to form an article having different thicknesses corresponding to the different intensities of the original image.

5

8. A method according to Claim 7, in which the mould is formed of metal.

9. A method according to Claim 7 or 8, in which the  
10 step of forming the mould is an engraving step.

10. A method according to any one of Claims 1 to 6, in which the step of forming the article comprises the step of engraving translucent material.

15

11. A method according to Claim 6, 9 or 10, in which the engraving step is achieved using a numerically controlled engraving machine.

20 12. A method according to Claim 6, 9 or 10, in which the engraving step is achieved using laser engraving.

13. A method according to any one of the preceding claims, in which the article is formed from a plastics  
25 material.

14. A method according to any one of Claims 1 to 12, in which the article is formed from a confectionery material, such as candy or chocolate.

30

15. A method according to any one of Claims 1 to 12, in which the article is formed from a soap.

16. A method according to any one of Claims 1 to 12, in  
35 which the article is formed from a wax.

17. A method according to any one of the preceding claims, in which the material includes luminescent particles.

5 18. A method according to any one of the preceding claims, including the further step of providing a luminescent layer on or in the article.

19. A method according to any one of the preceding  
10 claims, in which the article is formed of a coloured material.

20. A method according to any one of the preceding claims, including the further step of providing a  
15 coloured layer on or in the article.

21. A method according to any one of the preceding claims, in which the article is made from a heat sensitive material whose light transmissive properties  
20 vary dependent on the temperature of the material.

22. An article formed of a plastics material, the article having different thicknesses at different points corresponding to the relative intensity of an image.

25

23. An article formed of a confectionery product, such as candy or chocolate, the article having different thicknesses at different points corresponding to the relative intensity of an image.

30

24. An article formed of soap, the article having different thicknesses at different points corresponding to the relative intensity of an image.

35 25. An article formed of wax, the article having different thicknesses at different points corresponding to the relative intensity of an image.

26. An article comprising a container containing a liquid, the container being shaped to be of variable width, the width at different points corresponding to the relative intensity of an image.

5

27. An article according to any one Claims 22 to 26, in which the material includes luminescent particles.

28. An article according to any one of Claims 22 to 27,  
10 in which a luminescent layer is provided on or in the article.

29. An article according to any one of Claims 22 to 28,  
in which the article is formed of a coloured material.

15

30. An article according to any one of Claims 22 to 29,  
in which a coloured layer is provided on or in the article.

20 31. An article according to any one of Claims 22 to 30,  
in which the article is made from a heat sensitive material whose light transmissive properties vary dependent on the temperature of the material.

25

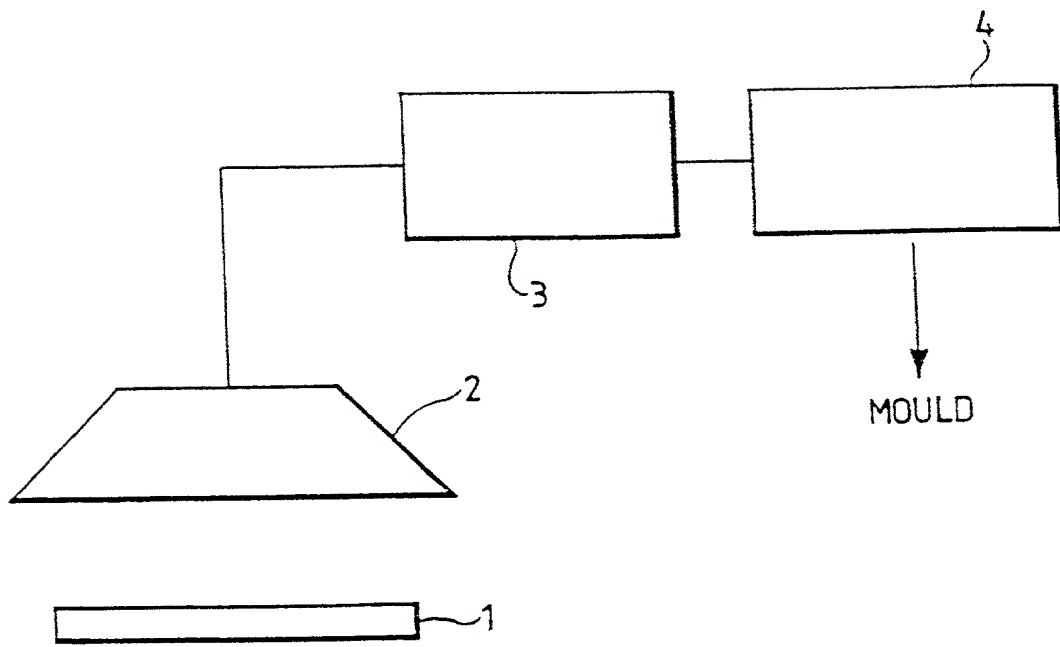


Fig.1.

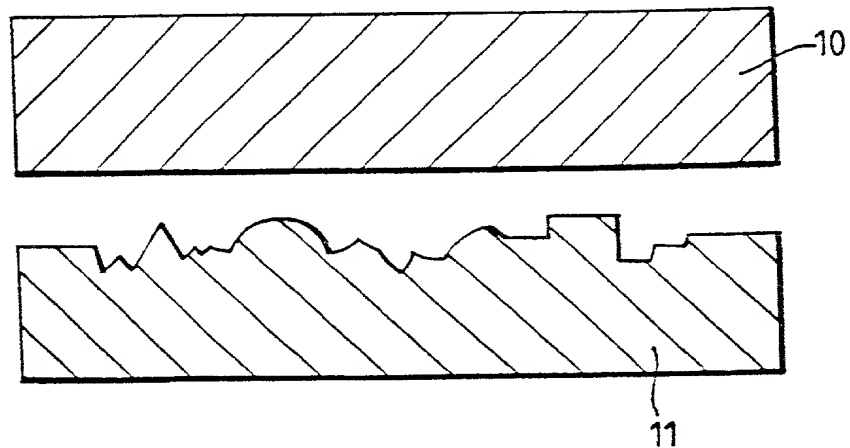


Fig.2.

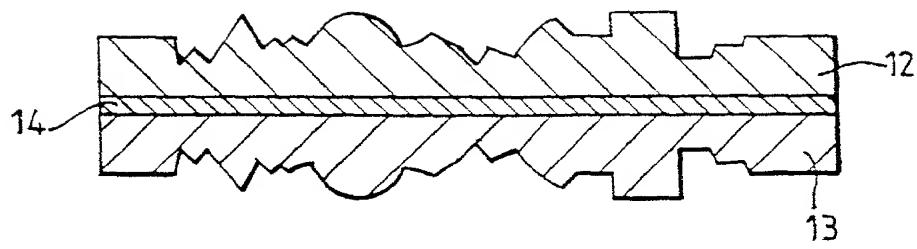


Fig.3.

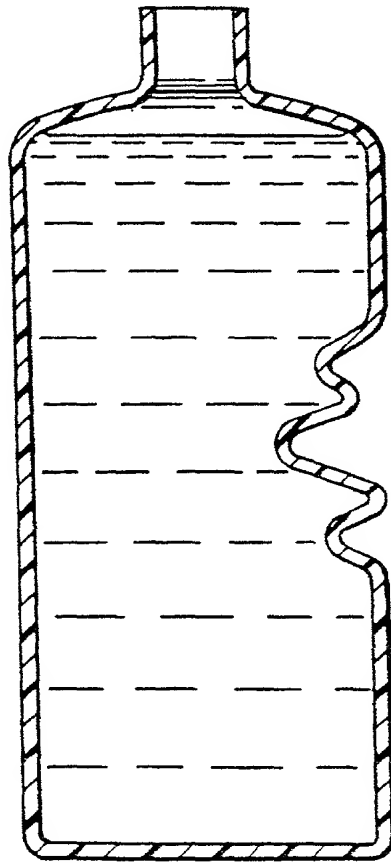


Fig.4.

|                               |
|-------------------------------|
| Docket No.<br><u>32414.23</u> |
|-------------------------------|

## Declaration and Power of Attorney For Patent Application

### English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

#### LITHOPHANE-LIKE ARTICLE AND METHOD OF MANUFACTURE

the specification of which (check one)

☐ is attached hereto.

☒ was filed on 18 June 1999 as United States Application No. or PCT International Application Number PCT/GB99/01936 and was amended on \_\_\_\_\_ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

9821658.3

(Number)

Great Britain

(Country)

05 October 1998

(Day/Month/Year Filed)

☐

9823062.6

(Number)

Great Britain

(Country)

21 October 1998

(Day/Month/Year Filed)

☐

\_\_\_\_\_  
(Number)

\_\_\_\_\_  
(Country)

\_\_\_\_\_  
(Day/Month/Year Filed)

☐

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

|                                   |                        |
|-----------------------------------|------------------------|
| _____<br>(Application Serial No.) | _____<br>(Filing Date) |
| _____<br>(Application Serial No.) | _____<br>(Filing Date) |
| _____<br>(Application Serial No.) | _____<br>(Filing Date) |

I hereby claim the benefit under 35 U.S.C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C.F.R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

|   |  |  |
|---|--|--|
| PCT/GB99/01936<br>_____<br>(Application Serial No.) | 18 June 1999<br>_____<br>(Filing Date) | Pending<br>_____<br>(Status)<br>(patented, pending, abandoned) |
| _____<br>(Application Serial No.)                   | _____<br>(Filing Date)                 | _____<br>(Status)<br>(patented, pending, abandoned)            |
| _____<br>(Application Serial No.)                   | _____<br>(Filing Date)                 | _____<br>(Status)<br>(patented, pending, abandoned)            |

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (*list name and registration number*)

10 Philip M. Goldman, Registration No. 31,162; James R. Haller, Registration No. 24,906; Steven J. Keough, Registration No. 33,190; Thomas L. McMasters, Registration No. 45,593; Alicia Griffin Mills, Registration No. 46,933; Adonis Neblett, Registration No. 32,358; Charles D. Segelbaum, Registration No. 42,138; Mary P. Bauman, Registration No. 31,926; Eric J. Snustad, Registration No. 45,120; and David C. West, Registration No. 35,735

Send Correspondence to: Charles D. SEGELBAUM  
Fredrikson & Byron, P.A.  
900 Second Avenue South  
1100 International Centre  
Minneapolis, Minnesota 55402

Direct Telephone Calls to: Charles D. SEGELBAUM  
612-347-7115

Full name of sole or first inventor

John Francis DUFORT

Sole or first inventor's signature

Date

30 JULY 2001

Residence

Great Britain GB

Citizenship

Great Britain

Post Office Address

91 Egloshayle Road, Wadebridge, Cornwall PL27 6AF, Great Britain

Full name of second inventor

Second inventor's signature

Date

Residence

Citizenship

Post Office Address